NOAA-wide Tsunami Talking Points
Updated 3/18/2005

Key Messages – Try to include these in ANY conversation about Tsunamis

- An effective tsunami warning system must include four key components:
  1) Detect the hazard
  2.) Assess the risk
  3.) Disseminate the warning
  4.) Respond -- An educated public needs to know what to do when a warning is sounded (through programs like TsunamiReady, which provides community-based public awareness)

- The current and future expansion of the U.S. Tsunami Warning System includes all four components.

- The tragedy that resulted from the December Indian Ocean tsunami focused world attention on the threat of tsunamis and the need to have all four of these components in place.

- NOAA has operational responsibility for the U.S. Tsunami Warning System, but this is a true team effort with other federal partners such as the U.S. Geological Survey (USGS), local and regional emergency managers, the media and a host of other important players.

General Information on Tsunamis

- Tsunami (*soo-NAH-mee*) is a Japanese word meaning "harbor wave." It is a series of ocean waves created by a sudden displacement of seawater.

- A local tsunami is the result of an earthquake or other water-displacing event occurring just offshore. People in affected areas may only have minutes to act.

- Teletsunamis are waves that travel from the source across the open ocean. These may take several hours to reach affected populations. Typically, there can be five to 60 minutes between the wave crests. The first wave may not be the largest. The second wave is often deadlier, as it carries more debris.

- Most tsunamis are generated by undersea earthquakes (generally a magnitude of 7.5 or higher), but they can be caused by other sudden displacements of seawater – such as submarine landslides, volcanic eruptions and, in very rare instances, meteor strikes.

- Not all major (7.0 M or higher) earthquakes generate tsunamis. Tsunamis are generated by vertical movement of the sea floor. If the sea floor movement is horizontal, a tsunami would not be generated. There could be a large coastal

earthquake with horizontal motion. Since there is no way of knowing *immediately* if the sea floor displacement is vertical or horizontal and given the speed with which a tsunami can travel – a warning will still be issued.

- Tsunamis travel quickly across oceans… more than 500 mph (about the speed of an airliner) in deep water. In the open ocean, wave height is nearly undetectable (typically less than three feet) except by sophisticated instruments, but increases as the wave nears the shore. Damage from tsunamis results from the force of the waves, the debris they carry, and resulting flooding, fires and other impacts.

World-wide Tsunami Risks

- Most tsunamis (approximately 85 percent during the last 100 years) occur in the Pacific Basin, which covers more than one-third of the earth's surface and is surrounded by a series of mountain chains, deep-ocean trenches and island arcs called the "Ring of Fire." It is here where most seismic activity occurs as the main tectonic plates forming the floor of the Pacific collide against one another or against the continental plates that surround the ocean basin.

- During the last century, nearly 800 tsunamis were observed or recorded in the Pacific Ocean.

- At least 40 tsunamis or rogue waves have impacted the eastern United States during the last four centuries, but only one Atlantic-wide tsunami has been documented (1755 Lisbon earthquake).

- It is estimated that approximately 2,500 people have been killed during numerous tsunami events in the Caribbean over the last 150 years. They include tsunamis that struck Venezuela (1853 and 1906), Virgin Islands (1867), Panama (1882), Puerto Rico (1918), Dominican Republic (1946) and Costa Rica (1991).

The Current U.S. Warning System

- NOAA operates two tsunami warning centers under the direction of NOAA's National Weather Service:

  (1) The Richard H. Hagemeyer Pacific Tsunami Warning Center, in Ewa Beach, Hawaii
  (2) The West Coast/Alaska Tsunami Warning Center, in Palmer, Alaska

- The two NOAA warning centers are responsible for issuing tsunami warnings, watches, advisories and information messages to emergency management officials and the public. The Pacific center covers U.S. interests and territories throughout the Pacific, including Hawaii. The Alaska center covers Alaska and the west coast of North America from British Columbia, Canada, to California.

- NOAA conducts research on tsunamis; operates ocean buoys (see DART Buoy System) and tide gauges (see Tide Gauge Networks) to detect tsunamis; and partners with other federal, state and local government agencies, academia and private industry.

The DART Buoy System

- NOAA designed the Deep-ocean Assessment and Reporting of Tsunamis (DART) system to measure tsunamis in the deep ocean and to transmit the information to the two NOAA tsunami warning centers.

- DART stations have been sited in regions with a history of generating destructive tsunamis to ensure early detection of tsunamis and to acquire data critical to real-time forecasts. The current system was deployed in 2001 and consists of six buoy stations – three off the Alaskan coast, two off the western U.S. coast, and one southeast of Hawaii.

- DART stations consist of an anchored seafloor bottom pressure recorder (BPR) and a companion moored surface buoy for real-time communications. An acoustic link transmits data from the BPR on the seafloor to the surface buoy. The data are then relayed via a satellite link to ground to NOAA's Tsunami Warning Centers. See graphic at http://www.ndbc.noaa.gov/Dart/dart.shtml.

- Two DART buoys off the Aleutian Islands are currently inoperable. Severe winter weather has delayed repair of these DARTs until late spring/early summer 2005.

NOAA Tide Gauge Networks

- About 100 water level gauges are used by the Tsunami Warning Centers and are operated by the United States and international partners. Most of the gauges are near islands or along the Pacific Rim coasts.

- The NOAA National Water Level Observation Network (NWLON) is a network of 175 multi mission water level stations nationwide. Thirty-three NWLON stations in the Pacific basin have modified software and satellite transmission capability for high rate data collection when automatically or manually triggered during tsunami events. These high rate data are obtained directly by the tsunami warning centers.

- Present planning is to enhance the NWLON with upgraded data collection platforms with six-minute satellite transmission capability allowing for automated tsunami transmissions data with a minimum of 22 tsunami priority locations completed by the end of FY06. In addition, 10 new NWLON stations will be established in FY05 and FY06 in the Pacific Basin and six new NWLON stations will be established in FY05 and FY06 in the Atlantic/Caribbean Basin. These new stations are at locations identified as critical gaps by the tsunami warning centers.

- The University of Hawaii Sea level Center (UHSLC) operates an international network of 37 tide station, and assists host countries with seven more stations, in support of the NOAA Climate Program. Many of the stations are located on ocean islands. Several of these stations have upgraded capabilities to provide data to the tsunami warning centers through high rate sampling and data transmission and the data are provided directly to the tsunami warning centers.

U.S. Expansion Efforts

- Efforts are underway worldwide to enhance tsunami warning, dissemination and education programs.

- In the U.S., the two primary efforts are:

  1) A Bush Administration proposal to expand the U.S. tsunami detection and warning capabilities as part of the Global Earth Observation System of Systems (GEOSS), the international effort to develop a comprehensive, sustained and integrated Earth observation system

  2) An interim plan to better protect the Atlantic and Caribbean/Gulf coasts from tsunami threats.

The Administration's Proposal

- The administration has committed $37.5 million to the U.S. tsunami detection and warning capabilities. This funding will be allocated to USGS ($13.5) and NOAA ($24 million). NOAA is projected to receive $14.5 million in FY05 as a supplemental appropriation and $9.5 million in FY06 as part of the FY06 President's budget.

- The recurring cost for NOAA to maintain the warning system is currently being determined as part of NOAA's FY 2007 budget formulation process.

- Under the Administration's proposal, the U.S. tsunami warning system will include a network of 36 second generation DART buoy stations: 29 in the Pacific and seven in the Atlantic/Caribbean. There is a graphic with the proposed buoy locations at ttp://www.noaanews.noaa.gov/stories2005/s2369.htm. NOAA also plans to add three redundant DART buoys for the Alaska DART network to compensate for potential buoy system outages that may occur during the severe Alaska winter that precludes on-site system repairs.

- The Administration's two-year plan to strengthen the U.S. Tsunami Warning Program provides NOAA with $24M. NOAA will use this $24M to:

  1) accelerate and expand its tsunami hazard assessment programs (tsunami inundation mapping)

2) strengthen its tsunami detection networks and warning systems (expand the DART systems, expand NOAA's tsunami-reporting sea-level monitoring stations, modernize NOAA's seismic network and expand NOAA Tsunami Warning Center Operations to 24/7) and

3) accelerate and expand NOAA's community-based tsunami education and preparedness programs (i.e., Tsunami Ready communities).

- The second generation DART buoy systems will be more robust and better equipped to handle the harsh ocean environment and will have two-way communication capabilities.

Interim System

- The threat of a tsunami in the Atlantic generated from an earthquake is lower than in the Pacific. Nevertheless, there is a need to establish a tsunami warning system for the Atlantic, Caribbean and Gulf regions, as these coastal areas are densely populated, highly attractive tourist destinations and have significant economic resources.

- After the tragic Indian Ocean tsunami, NOAA expanded its efforts to protect the citizens in the coastal communities along the Eastern Seaboard and Gulf of Mexico by implementing a multi-phased interim tsunami warning.

- As of January 2005, the West Coast/Alaska Tsunami Warning Center in Palmer, Alaska, coordinates with the NOAA National Weather Service Eastern and Southern regions to disseminate tsunami information, watches or warnings to coastal communities along the United States Eastern Seaboard and Gulf of Mexico.

- The Pacific Tsunami Warning Center in Hawaii coordinates with the National Weather Service Forecast Office in San Juan and the Puerto Rico Seismic Network to provide tsunami information for the island.

- The West Coast/Alaska Tsunami Warning Center monitors seismic data from seismometers which record earthquake shaking. Located throughout the lower 48 states and Caribbean islands, these instruments transmit the data to the center's computers in Palmer.

- The West Coast/Alaska Tsunami Warning Center can also determine if a tsunami has been generated by checking water level data from tide gauges located in coastal areas along the eastern seaboard, Gulf of Mexico and Puerto Rico.

- In Phase One of the interim program, the West Coast/Alaska Tsunami Warning Center monitors the Atlantic Basin and Gulf of Mexico. If an earthquake is noted,

the center will send Tsunami Information Bulletins, Watches or Warnings to the National Weather Service Forecast Office in Melbourne, Fla.

- The Melbourne Forecast Office would use the Coastal Hotline (in place for Hurricane information dissemination) to alert affected Weather Forecast Offices in the Eastern and Southern regions. As soon as they receive the alerts, the offices would disseminate information via NOAA Weather Radio, the Emergency Alert System and the NOAA Weather Wire for emergency management officials and the media.

  - The message may be a *Tsunami Information Bulletin* noting the location and magnitude of the quake and an evaluation of the potential for a tsunami.

  - A *Tsunami Watch* indicates a tsunami has been detected and could affect all or a portion the (East Coast) or (Gulf of Mexico). It means the risk of a tsunami has increased, but its occurrence and timing are uncertain.

  - A *Tsunami Warning* indicates a tsunami is (occurring, imminent or highly likely) and would contain a *call to action*, such as, "move to higher ground" or "monitor NOAA Weather Radio."

  - When appropriate, the center may also issue a *Tsunami Watch/Warning Cancellation* for all or portions of the coastal areas

- Phase Two of the interim service will be a more comprehensive information dissemination system.

- In the second phase, the West Coast/Alaska Tsunami Warning Center would continue to monitor seismic activity and provide the *Informational Bulletins, Tsunamis Watches* and *Warnings,* but the messages would follow simultaneous communication paths from the West Coast/Alaska Tsunami Warning Center to the Federal Emergency Management Agency's National Warning System (NAWAS), NOAA Weather Wire, National Weather Service communications circuit, Federal Aviation Agency's communication system, the U.S. State Department (notifies Canada and Mexico as appropriate) and the public via Internet.

- During Phase Two, coastal Weather Forecast Offices in the Southern and Eastern regions would still be responsible for issuing warnings or Civil Emergency Messages for Emergency Alert System activation through NOAA Weather Radio.

- In the future, National Weather Service offices will transition to Emergency Alert System codes designated as TSA (Tsunami Watch) and TSW (Tsunami Warning).

International Efforts

- NOAA's Pacific Tsunami Warning Center serves as the operational center for the International Tsunami Warning System of the Pacific, which is comprised of 26 member nations of the Pacific Rim.

- The Pacific center's primary responsibility is to issue tsunami warnings for Pacific Basin teletsunamis. Local tsunami warnings for seismic events outside of the United States are the responsibility of nation's proximate to their occurrence. For example, if an earthquake occurs off the coast of Japan and a local tsunami is generated, it is Japan's responsibility to issue a local tsunami warning. The Pacific center is responsibility for warning all participating nations in the Pacific Basin if the Japanese event is a teletsunami.

- The U.S. is working with international partners, such as the Intergovernmental Oceanographic Commission; the World Meteorological Organization; and the governments of India, Indonesia, Sri Lanka, Malaysia and others to determine what it would take to establish a fully functional international tsunami warning system that will serve the global community. Such a system is within the world's current technological capabilities, but bringing it online will require resources and partners in every region and from many sectors of our governments and societies.

GEOSS

- Through the Global Earth Observation System of Systems and with international partners, the United States will provide leadership in planning and implementing a global observation system that would include a global tsunami warning system.

TsunamiReady

- TsunamiReady is a voluntary program designed to educate local emergency management officials and their constituents, and to promote a well-designed tsunami emergency response plan for each community.

- TsunamiReady promotes tsunami hazard preparedness as an active collaboration among federal, state, and local emergency management agencies. This collaboration supports greater and more consistent tsunami awareness and mitigation efforts among communities at risk.

- The criteria for being recognized as a TsunamiReady Community includes establishing an Emergency Operating Center, warning systems, a community preparedness program, identification of hazard zones, and establishing evacuation routes and safe areas. Also required is the establishment of plans and drills for schools in hazard zones.

- This kind of planning, preparedness and mitigation changes the impact that earthquakes and tsunamis have on communities, and results in a community that is safer and more disaster resistant.

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